

REMARKS/ARGUMENTS:

Claims 1-11 are pending in the application. Reexamination and reconsideration of the application, in view of the following remarks, are respectfully requested.

The present invention relates to a print mask for screen printing used for printing a printing paste onto a wafer so as to form bumps or protrusion electrodes on barrier metal layers provided on the wafer. The present invention includes a method of electronic components by using the print mask, and relates particularly to a method of manufacturing a flip-chip integrated circuit that is mounted on a circuit board by face-down bonding. (Applicant's specification, at p. 1, lines 6-13).

INTERVIEW SUMMARY:

On October 30, 2007, Patent Agent Barry Shuman conducted a telephone interview with Examiner Chuong A. Luu. During the interview, the Agent stated how the present invention was different from and overcame Kariya et al. (U.S. Patent Publication No. 2006/0237225).

Specifically, the Agent explained how in Kariya, Figure 11B, there were not any inclined perforations. In contrast, in the present invention (independent claim 1), the perforations are inclined (Figure 3). The Examiner agreed with the Agent.

In addition, the Agent explained how in Kariya, Figures 22A and 22B, the opening area of the perforation is not set smaller in the region of an arrangement where the density of arrangement of the perforations is higher. The Agent further explained how the circles in Figures 22A and 22B of Kariya were not perforations. In contrast, in the present invention (independent claim 4), the opening area of the perforation is set smaller in the region of an arrangement where the density of

arrangement of the perforations is higher (Figure 7). The Examiner agreed with the Agent.

Applicant would like to thank the Examiner for the courtesy of granting an interview.

CLAIM REJECTIONS UNDER 35 U.S.C. §102:

Claims 1, 2, and 4-6 stand rejected under 35 U.S.C. §102(b) as being anticipated by Kariya et al. (U.S. Patent Publication No. 2006/0237225). The Applicant respectfully traverses this rejection.

Claim 1 is as follows:

A print mask used to form bumps on barrier metal layers of a wafer comprising a plurality of perforations, in a plan view, each elongated and disposed in linear arrangement for applying a paste via the perforations onto an object of printing,

wherein each of said perforation includes an edge disposed along the longitudinal direction in a plan view, said edge being inclined with respect to the direction perpendicular to the direction of arranging the perforations.

Applicant respectfully submits that Kariya cannot anticipate or render obvious claim 1, because Kariya fails to teach or suggest "wherein each of said perforation includes an edge disposed along the longitudinal direction in a plan view, said edge being inclined with respect to the direction perpendicular to the direction of arranging the perforations."

As discussed above in the "Interview Summary" section, Kariya in Figure 11B fails to teach or suggest that the edge of the perforation is inclined, as is required by the present invention (Figure 3). In addition, as will be discussed in more detail below with respect to claim 4, the circles in Kariya do not represent

perforations of any kind, much less perforations of a print mask. Instead, the circles of Kariya represent "conductor circuits" (e.g., 36), "pads" (e.g., 36p), and "external terminals" (i.e., solder bumps such as 56).

In light of the foregoing, Applicant respectfully submits that Kariya cannot anticipate or render claim 1 obvious, because Kariya fails to teach or suggest each and every claim limitation. Claim 2 depends from claim 1 and cannot be anticipated or rendered obvious for at least the same reasons as claim 1. Withdrawal of this rejection is thus respectfully requested.

Claim 4 is as follows:

A print mask comprising a number of perforations disposed in a single row or a plurality of rows for applying and printing a printing paste via the perforations onto a wafer so as to form bumps on barrier metal layers provided on the wafer,

wherein the density of arrangement of said perforations is set differently from region to region within the arrangement and the opening area of said perforation is set smaller in the region of an arrangement where the density of arrangement of said perforations is higher.

Applicant respectfully submits that Kariya cannot anticipate or render obvious claim 4, because Kariya fails to teach or suggest "the opening area of said perforation is set smaller in the region of an arrangement where the density of arrangement of said perforations is higher."

Further to the arguments presented in the "Interview Summary" section, please consider the following:

Figure 22 of Kariya does not depict a print mask but is instead "a multi-layer printed wiring board." (Kariya, paragraph [0271]). The circles shown in Figure 22 are not "perforations" but are either circular copper (36, 36b) or a solder bump (56).

More specifically, Figures 22(A) and 22(B) are a plan view representation of Figures 21(A) and 21(B), respectively. The numerical reference 36 and 36p, respectively, represent a "conductor circuit" and "bonding pad", both of which are made by etching a copper foil into a circular pattern. (Kariya, paragraphs [0206], [0261], and [0271]-[0273]). The conductor circuit 36 is for forming a solder bump (BGA, ball grid array) 56 thereon. The bonding pad 36p is for bonding a connecting wire thereon. (Kariya, Figure 22(B)). Both the conductor circuit 36 and the bonding pad 36p are covered by the solder resist layer 40, in which an opening 44a is formed so a wire can be bonded on the bonding pad 36p. (Kariya, paragraph [0261], Figure 21(A)). The numerical reference 56 represents a BGA formed on the conductor circuit 36 by a printing method, in which solder paste is printed through a print mask. (Kariya, paragraphs [0212]-[0215], [0261], and [0271]-[0273]).

Neither the bonding pad 36p nor the conductor circuit 36 are formed by a printing method but instead are formed by etching a copper foil on the circuit board (Kariya, paragraphs [0206]-[0207]). A copper foil is covered by a photo resist and exposed to light following a predetermined circuit pattern and developed to form etching resist. By etching the copper foil through the resist, the conductor circuit 36 and the bonding pad 36a are formed. This is not a screen printing and does not use any print mask.

Kariya does teach forming a BGA 56 by a printing method, in which solder paste is printed through a print mask. (Kariya, paragraphs [0212]-[0215]). However, the size of BGA 56 does not vary in Figure 22. BGA 56 is formed along the periphery of the board with a constant pitch and size. In summary, Figure 22 of Kariya, and Kariya, in general, fails to teach or suggest the print mask of Applicant's claim 4.

It is an aspect of the present invention, that the density of the arrangement of the perforations may be varied within a row of perforations. In this case, too, an opening area of perforation is set to be smaller in the region having higher density of arrangement of perforations as shown in FIG. 9. This makes it possible to make the quantity of the solder paste 50 applied onto the barrier metal layers 3 substantially equal among all the perforations 7, thus making the sizes of the solder bumps formed on the barrier metal layers 3 of the electronic components equal. (Applicant's specification, at p. 27, lines 14-23).

The use of the print mask of claim 4 should allow the obtaining of columns of solder bumps having an equal size in each column regardless of a difference in the density of solder bumps between the columns. Even if the circles 36 and 36p in Figure 22 of Kariya were solder bumps, the arrangement found in Figure 22 would not be an expected result of using the print mask of claim 4.

In light of the foregoing, Applicant respectfully submits that Kariya cannot anticipate or render claim 4 obvious, because Kariya fails to teach or suggest each and every claim limitation.

Claims 5 and 6 depend from claim 4 and cannot be anticipated or rendered obvious for at least the same reasons as claim 4. Withdrawal of this rejection is thus respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. §103:

Claim 3 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Kariya. The Applicant respectfully traverses this rejection. Claim 3 depends from Claim 1 and therefore, cannot be rendered obvious over Kariya for at least the same reasons discussed above. Withdrawal of this rejection is thus respectfully requested.

Appl. No. 10/786,890  
Amdt. Dated October 31, 2007  
Reply to Office Action of August 1, 2007

Attorney Docket No. 81880.0114  
Customer No. 26021

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, in view of the foregoing remarks, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (310) 785-4600 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,

HOGAN & HARTSON L.L.P.

Date: October 31, 2007

By:



Barry M. Shuman

Registration No. 50,220

1999 Avenue of the Stars, Suite 1400  
Los Angeles, California 90067  
Phone: 310-785-4600  
Fax: 310-785-4601